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Scintigraphic Evaluation of Reconstructive Surgery in Gastrectomy for Gastric Cancer

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Summary

Scintigraphic evaluation of reconstruction in 87 patients who received gastrectomy with dissection of regional lymphnodes is presented. The patients who underwent Roux-Y reconstruction had postcibal asynchronism for 56–59 min, while those who underwent reconstructive surgery by jejunal interposition had less postcibal asynchronism for 8–33 min ($p<0.001$). In the subtotal gastrectomy cases, the bile reflux into the gastric remnant was not observed in those who underwent reconstruction by Roux-Y or jejunal interposition, while it was seen at high frequency in those who underwent Billroth I ($p<0.05$) or Billroth II ($p<0.01$).

These findings indicated that jejunal interposition was more physiological than other methods for reconstruction.

Introduction

Cholescintigraphy has so far been utilized mainly for the static study to identify the shape and position of the liver, or the degree of uptake of scanning agents as a whole, or the space occupying lesion[9]. In an attempt to make a dynamic study on bile excretion into digestive tract in the field of gastric surgery, cholescintigraphy was performed using scintillation camera connected with a computer to obtain time-activity (T-A) curves from each region of interest (ROI) on the images, with which time-dependent quantitative analysis on bile flow was carried out, additionally followed by simultaneous quantitative analysis with gastroscintigraphy; these techniques were used for the assessment of the methods of reconstructive surgery by means of postcibal asynchronism (PA), bile reflux into the gastric remnant and gallbladder function.

Materials and Methods

1. Patients studied:

Eighty-seven patients who had undergone gastrectomy for their gastric cancer were studied.

Key words: Scintigraphy, Gastrectomy, Postcibal asynchronism, Truncal vagotomy, Bile reflux into gastric remnant.

索引用語・シンチグラフィー，胃切除術，食後アシンクロニズム，幹迷走神経切離術，胆汁残胃内逆流.

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They consisted of 60 total gastrectomies and 27 subtotal gastrectomies. In totally gastrectomized patients, 39 were reconstructed with Roux-Y, and 21 with jejunal interposition. In subtotally gastrectomized patients, 5 were reconstructed with Billroth I, 7 Billroth II, 9 Roux-Y, and 6 jejunal interposition. In all, dissection of regional lymphnodes was carried out, resulting in the same condition as in the case of truncal vagotomy.

2. Cholescintigraphy:

After an overnight fast, with the patient supine, 3.0–5.0 mCi of Tc-99m-N-(2,6-diethylacetoanilide)-iminodiacetic acid (Tc-99m-E·HIDA) was injected intravenously and then a test meal of 380 kcal consisting of bread, butter and soup was immediately given orally. Sequential scintigrams of the liver and biliary tract were recorded for 60 min using Pho/Gamma LEOV scintillation camera (Siemens, West Germany) with a low energy all purpose collimator (15,000 holes, 140 keV) interfaced to a Scintipac 1,200 minicomputer (Nova 32 KW, Shimadzu, Japan). The scintigrams obtained were later reproduced to obtain the respective T-A curves from the ROI set up optionally on the images.

3. Simultaneous performance of cholescintigraphy and gastroscintigraphy and its quantitative analysis:

The collimator used in the above 1 was replaced by a medium energy parallel collimator (5,200 holes, medium energy, 300 keV), and the apparatus was adjusted so that both scintigraphies can be performed simultaneously on the same pictures. Chlescintigraphy was the same as above 1; for gastroscintigraphy, a test meal (soup) labeled with 200 μCi of In-111-diethylene-triamine pentacetic acid (In-111-DTPA) was used.

4. Definition of PA:

At the time of quantitative analysis of cholescintigraphy and gastroscintigraphy performed simultaneously, T-A curves from ROI set up on the area of upper small intestine on the respective scintigrams were obtained. On each T-A curve, the time during which the radionuclide activity

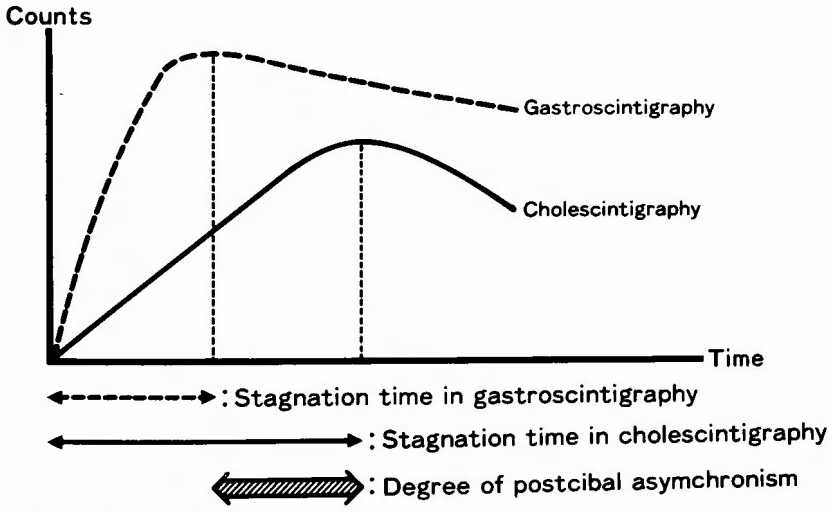

Fig. 1. Definition of stagnation time and postcibal asynchronism on time-activity curve.

reaches a peak was taken as stagnation times of bile and food, respectively. The degree of PA was expressed by the difference between these two stagnation times (Figure 1).

5. Statistical evaluation:

For statistical evaluation of significant difference, the Student's t-test was used.

Results

1. Cholescintigraphy in the patients who underwent total gastrectomy:

The images obtained by postoperative time in patients who had received Roux-Y recon-

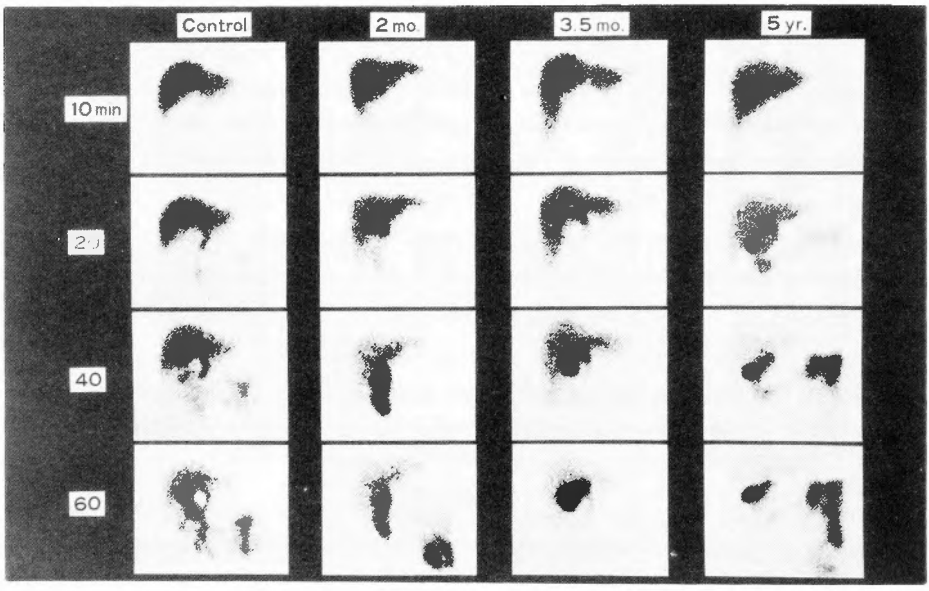

Fig. 2. Cholescintigrams after total gastrectomy with Roux-Y reconstruction.

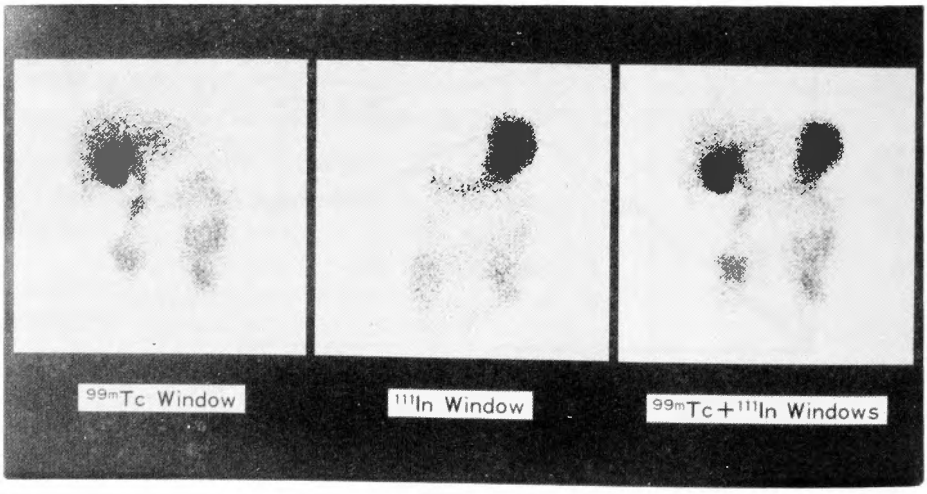

Fig. 3. Double isotope scintiscans in a healthy subject.

Table 1. Postcibal asynchronism in patients after total or subtotal gastrectomy.

Operation	No. of patients	Postcibal asynchronism (min)	p
Total : Roux-Y	20	58.8 ± 7.1	***
Jejunal interposition	15	33.0 ± 16.0	
Subtotal : Billroth I	5	33.0 ± 16.9	*
Billroth II	7	53.6 ± 9.1	*
Roux-Y	9	55.6 ± 12.8	***
Jejunal interposition	6	7.5 ± 16.8	***

(Mean ± SD, * $p<0.05$, ** $p<0.01$, *** $p<0.001$)

struction are shown in Figure 2. As compared with controls, the delay in bile excretion into digestive tract was noted on the images of 2 months and 3.5 months after surgery. However, this delay was considerably improved after the lapse of 5 years.

2. Quantitative analysis of cholescintigraphy and gastroscintigraphy:

(1) Healthy subject:

Figure 3 shows an image at 30 min after the start of study in a 36-year-old woman. Movement of bile and food in the digestive tract and mixing of them were clearly observed. No PA was noted on the images.

(2) PA observed by reconstructive surgery:

The results obtained in patients who had undergone surgical operation at one to two months before this study are shown in Table 1. In cases of total gastrectomy, the degree of PA was mild

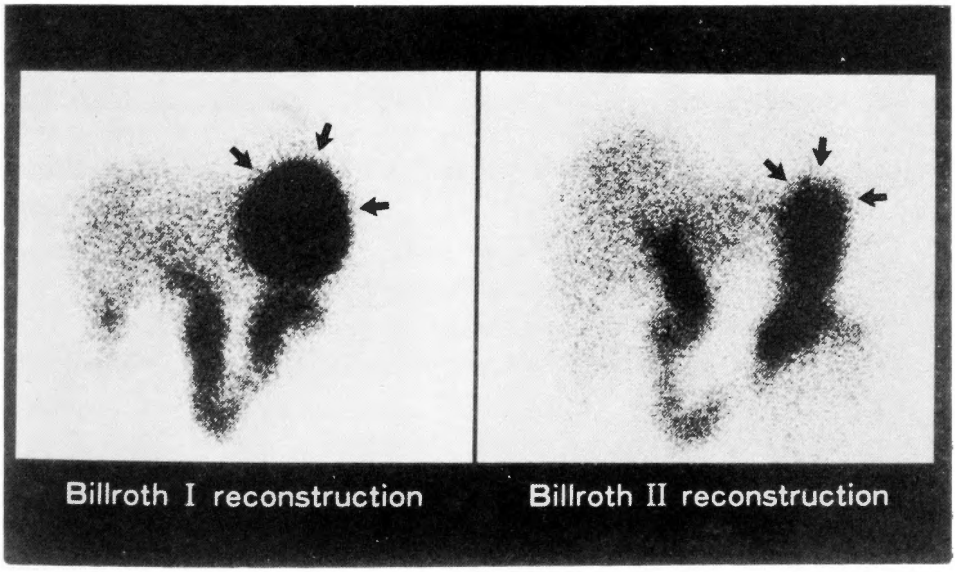

Fig. 4. Bile reflux into the gastric remnant. Arrows show the area of the gastric remnant.

Table 2. Bile reflux into the gastric remnant in patients after subtotal gastrectomy.

Reconstruction	No. of patients	Reflux (+)	Incidence (%)	p
Billroth I	5	3	60.0	
Billroth II	7	5	71.4	*
Roux-Y	9	0	0	** *
Jejunal interposition	6	0	0	

(*$p<0.05$, **$p<0.01$)

in the cases of jejunal interposition as compared with those of Roux-Y, whereas in cases of subtotal gastrectomy, PA was least in degree in those of jejunal interposition and became marked in the order of those of Billroth I, II, and Roux-Y.

3. Bile reflux into the gastric remnant:

Figure 4 shows bile reflux into the gastric remnant in patients after subtotal gastrectomy. The frequency of bile reflux by method of reconstruction was significantly high in the Billroth II cases, followed by the Billroth I cases; no reflux was observed in both cases of Roux-Y and jejunal interposition (Table 2).

4. Abnormalities of the gallbladder images:

Figure 5 shows typical abnormalities of the gallbladder images in patients after total gastrectomy with Roux-Y reconstruction. As shown in Table 3, the incidence of such abnormalities was high in the cases of total gastrectomy with Roux-Y and in those of subtotal

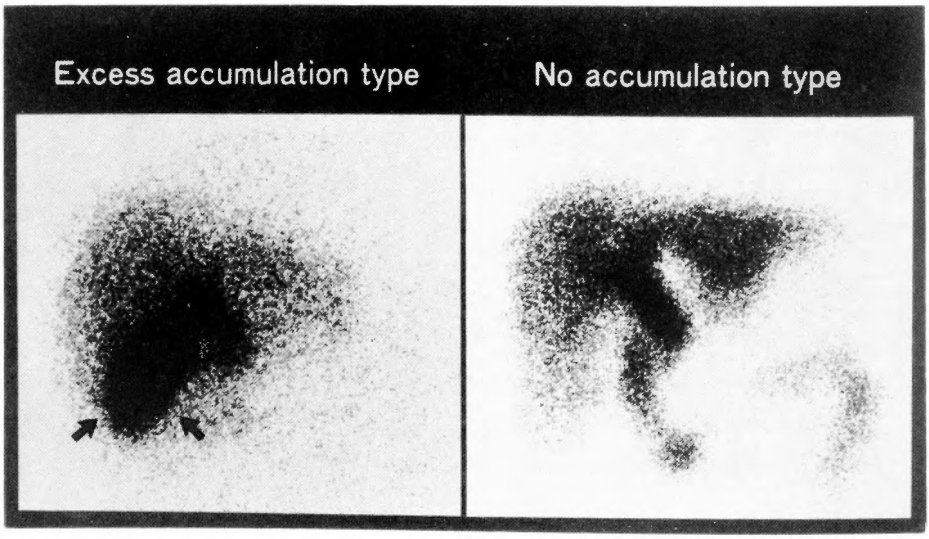

Fig. 5. Abrormalities of the gallbladder images in patients after total gastrectomy with Roux-Y reconstruction. Arrows show the area of the gallbladder.

Table 3. Abnormality of the gallbladder image in patients after total or subtotal gastrectomy.

Operation	No. of patients	Abnormality (+)	Incidence (%)	p
Total : Roux-Y	20	17	85.0	*
Jejunal interposition	15	7	46.7	
Subtotal : Billroth I	4	2	50.0	
Billroth II	6	4	66.7	
Roux-Y	9	7	77.8	
Jejunal interposition	6	2	33.3	

(*$p<0.05$)

gastrectomy with Billroth II; in the cases of jejunal interposition, the incidence was low irrespective of total or subtotal gastrectomy.

Discussion

Scintigraphy is non-invasive for the subjects, and except special cases, it requires no specific skill in manipulation, only needing a 12 hrs fast as pretreatment. So, it is one of the most simple testing methods. Availing ourselves of these advantages of this technique, we observed the presence of PA after total gastrectomy. Further, utilizing the quantitative analysis of cholescintigraphy and gastroscintigraphy performed simultaneously, we observed the movement of bile and food in the digestive tract individually or in mixture on the same picture. This double isotope method made possible for us to observe PA more precisely.

In the present study, the cases of gastric cancer underwent total or subtotal gastrectomy with dissection of regional lymphnodes, and in those which received Roux-Y anastomosis or Billroth II anastomosis in reconstruction, PA was found remarkable. This findings was consistent with a report by GOBBEL[8] that in a fat absorption test the fat excretion rate in feces was 4% by oral administration of a test meal while it increased to 18–57% when the same test meal was infused directly to the jejunum.

In either of beta anastomosis or Roux-Y anastomosis of esophagojejunostomy, food does not pass through the duodenum, but in jejunal interposition food passes through the duodenum, thereby accelerating secretion of gut hormones by stimulation to the duodenal mucosa and giving rise to secretion of bile and pancreatic juice; thus the mixing of food with them seems to become more physiological. In the cases which underwent subtotal gastrectomy, even by Billroth I anastomosis, food passes through the duodenum; however, there would be a risk of bile reflux into the gastric remnant[5,14] or of the development of cancer of gastric remnant due to such bile reflux[2,12,13]. Therefore, the reconstruction by jejunal interposition would be best in these cases too. In our observation, PA was found least in the cases which underwent reconstruction by jejunal interposition, demonstrating it to be a physiological method for reconstruntion.

The delay in bile flow into the digestive tract would impair the micelle formation by bile acids which are necessitated for fat absorption[1].

In total or subtotal gastrectomy for gastric cancer, the dissection of regional lymphnodes is eventually the same to the truncal vagotomy from the standpoint of vagal transection. Abnormalities in the postoperative images of gallbladder seem to be due mainly to this truncal vagotomy[3,10], and this phenomenon is said to be caused by functional obstruction of the cystic duct[4,6,7]. WILLIAMS[15] indicated that postcibal symptoms such as dumping symptom, full feeling of abdomen or anorexia seen after gastrectomy are related to vagotomy and that the incidence of such symptoms decreases to only 3% at the second year after surgery from 12% at the first year after surgery. This finding is very close to our observations on the recovery of PA. It is supposed that with the lapse of time, the excreting behavior of bile into small intestine is becoming near normal, that is, the improvement of PA largely depends on the humoral effect involving changes in secreting behavior of cholecystokinin[11].

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和文抄録

シンチグラフィーによる胃癌胃切除後の再建術式の評価

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上田　耕臣，佐々木政一，川嶋　寛昭，竹井　信夫，勝見　正治

胃癌に対し，胃切除，所属リンパ節郭清を行った87症例を対象に，その再建術式についてシンチグラフィーを用いて検討を加えた．Roux-Y による再建の postcibal asynchronism (PA) は，全摘，亜全摘を問わず56～59分と長く，一方食道十二指腸間，あるいは残胃十二指腸間有茎空腸間置術による再建での PA は8～33分と短かかった ($p<0.001$)．亜全摘症例について，胆汁の残胃内逆流の有無，程度をみると，Roux-Y，空腸間置による再建では観察されず，これに比較して Billroth I ($p<0.05$) や Billroth II ($p<0.01$) による再建では高頻度に認められた．

これらの結果からみると，十二指腸を空置しない空腸間置による再建がより生理的であると考えられた．